Enabling a Better Aft Heat Shield Solution for Future Mars Science Laboratory Class Vehicles

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System studies are described that compare masses and estimated manufacturing costs of options for the as-flown Mars Science Laboratory (MSL) aft body Thermal Light Weight Ablator (SLA) 561-V and its thickness was not optimized using the standard TPS Sizer Tool widely used for heat shield design. Use of the TPS sizing tool suggests that optimization of the SLA thickness could reduce the aft heat shield mass by 40 percent. Analysis of the predicted aft-shell aerothermodynamics suggests that the bulk of MSL class entry vehicle heat shields could incorporate Advanced Flexible Reusable Surface Insulation (AFRSI). AFRSI has a well-established record of relatively inexpensive manufacturing and flight certification based on its use on the lee side of the Space Shuttle. Runs with the TPS Sizer show that the AFRSI solution would be 60 percent lighter than the as-flown SLA. The issue of Reaction Control System (RCS) heating on the aft shell could be addressed by locally impregnating the AFRSI with silicone to enhance its robustness to short bursts ofheating. Stagnation point arcjet testing has shown that silicone impregnated AFRSI performs well at heat rates of 115 W/cm^2 and 0.1 atmospheres for a duration of 40 seconds, far beyond conditions that are expected for MSL class vehicles. The paper concludes with a discussion of manufacturing processes for AFRSI, impregnation approaches and relative cost comparisons to the SLA solution.